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PROCEEDINGS

OF

THE ROYAL SOCIETY.

1844. No. 60.

November 30, 1844.

At the Anniversary Meeting,

The MARQUIS OF NORTHAMPTON, President, in the Chair.

Mr. Dollond, on the part of the Auditors of the Treasurer's Accounts, reported, that the total receipts during the past year, inclusive of a balance of 1994*l.* 7*s.* 1*d.*, carried from the account of the preceding year, amounted to 4603*l.* 18*s.* 2*d.*; and that the total amount of payments in the same period amounted to 2663*l.* 5*s.* 6*d.*, leaving a balance in the hands of the Treasurer of 1940*l.* 12*s.* 8*d.*

The thanks of the Meeting were given to the Auditors for the trouble they have taken in examining the Treasurer's Accounts.

The Duke of Hamilton was elected, on the part of the Society, a Trustee of the Soane Museum.

The Secretary then read the following lists of deceased Fellows of the Royal Society, and of those admitted into the Society since the last Anniversary in 1843.

List of Fellows of the Royal Society deceased since the last Anniversary (1843).

On the Home List.

William Allen, Esq.
Francis Baily, Esq.
Rear Admiral Sir Robert Barlow.
Rev. Henry Card.
James Carson, Esq., M.D.
William Stanley Clarke, Esq.
Rev. Daniel Cresswell, D.D.
John Dalton, Esq., D.C.L.
Rev. James Farquharson.
John Lewis Guillemard, Esq.
Sir Henry Halford, Bart.
Capt. Basil Hall, R.N.
Thomas Henderson, Esq.
Very Rev. Robert Hodgson, Dean of Carlisle.
Thomas Charles Hope, Esq., M.D.
James Macartney, Esq.
John Grant Malcolmson, Esq., M.D.
John Thomas Mayne, Esq.
Charles Savill Onley, Esq.

Right Hon. Sir Gore Ouseley.
Henry Robinson Palmer, Esq.
Rev. John Barlow Seale.
John Smirnove, Esq.
William Speer, Esq.
George Frederick Stratton, Esq., LL.D.
Robert Stearne Tighe, Esq.

Ceased to be a Fellow in default of his Annual Payment.

Lieut. H. A. Ormsby.

List of Admissions into the Royal Society since the last Anniversary (1843).

On the Foreign List.

His Majesty Frederick King of Saxony.

On the Home List.

Capt. William Allen, R.N.
David Thomas Ansted, Esq., M.A.
Archibald Billing, Esq., M.D.
John Bishop, Esq.
Edward Bury, Esq.
William Benjamin Carpenter, Esq., M.D.
Capt. F. R. M. Crozier, R.N.
Walter Crum, Esq.
Rt. Hon. the Earl of Haddington.
Charles James Hargreave, Esq., B.L.
Charles Hood, Esq.
William Henry Hyett, Esq.
Thomas Rymer Jones, Esq.
Thomas Kerigan, Esq., R.N.
Capt. Thomas A. Larcom, R.E.
Richard Quain, Esq.
Francis Ronalds, Esq.
John Frederick Stanford, Esq.
John Webster, Esq., M.D.

The President then addressed the Meeting as follows:—

Gentlemen,

The time has again come round for my addressing you, and for expressing my own gratitude, as well as yours, to your Council for their constant and zealous attention to the interests of the Royal Society. We have been compelled during several late years to have recourse to legal proceedings on the subject of the great tithes of Mablethorp, a portion of the Society's property, and I rejoice to say with success. In my last address, I was required to give our thanks to Mr. Watt and to Mr. Dollond for the valuable busts which they had kindly presented to us. That of Mr. Dollond is placed at the commencement of the staircase leading to our apartments, and serves to indicate that his valuable improvements in the construction of our telescopes have been so many steps to the acquisition of higher and higher knowledge of the great universe of which this globe forms so insignificant a part. By the liberality of Mr. Watt we shall soon be furnished with handsome pedestals for the busts of his father and of Sir Isaac Newton, the two great lights of British mechanical genius and British philosophical science. Mr. Gilbert has kindly undertaken to furnish a similar pedestal for the bust of his father, and we have thought it right to provide one for that of Sir Joseph Banks. These will shortly form a conspicuous ornament of our place of meeting.

The magnetical observatories are still carrying on their observations, both in Her Majesty's dominions and in foreign countries, and another naval officer, Lieut. Moore, has proceeded to the Antarctic Seas to complete a portion of the survey of Captain Sir James Ross, which was interrupted by stress of weather. That gallant and enterprising officer will, I hope, ere long give to us and to the public his own narrative of his important discoveries. Detailed accounts of the botany and zoology of the regions visited by him are preparing under the patronage of the Government, while Colonel Sabine is proceeding with the magnetical observations, which were the more immediate objects of this, one of the most important voyages of discovery ever undertaken.

During the course of the year just expired, the presence in England of the King of Saxony gave us the opportunity of obtaining the honour of his accession to the list of the Royal Members of our Society,—a circumstance the more gratifying, as His Majesty is a follower as well as a patron of science.

The cordial co-operation of His Imperial Majesty the Emperor of Russia in the magnetical inquiries carrying on by our own and other governments, mainly at the request of the Royal Society, makes us the more to regret that the shortness of his stay in England rendered it impossible for us to obtain his signature in our Charter-book in addition to those of so many other sovereigns. The absence from London of the King of the French during his late short stay in England, as well as our own vacation, precluded us from taking any steps for the election of that monarch. This we must all lament when we advert to the proximity of the two nations, and to the eminent services that so many men of the greatest genius, industry and talent on the other side of the Channel have rendered to science.

In thus adverting to the visits of these royal strangers to our sovereign, I trust that I shall neither be accused of adulation nor of introducing politics where they would be peculiarly unseasonable. In my opinion, science is herself so illustrious, that she can receive no additional wreath from any follower or patron, however exalted in rank or power, but, on the contrary, that she will confer honour on them. But though this be true of science in the abstract, yet a society like ours must gain by such additions to its ranks; and though the powerful of the earth cannot make the cause of science more intrinsically honourable, yet they can make her progress more easy and more rapid. As long as we feel that her advancement must promote all the best interests of humanity, so long we must rejoice to see the sovereigns of nations, differing in their language, their polity and their religion, nevertheless uniting to increase our knowledge of the wonderful works of the Author of Nature, and to augment our capability of employing that knowledge in the service of mankind.

The two Medals placed at our disposal by Her Majesty have been adjudged by your Council to Mr. Boole and Dr. Andrews, and the Copley Medal to Signor Matteucci of Pisa. I regret that the latter distinguished foreign philosopher, whom I and many of yourselves,

Gentlemen, had the pleasure of seeing this autumn in England, should not be still among us, that I might have the opportunity of bestowing it in person.

Mr. Daniell,

I beg to present to you the Copley Medal for your friend Signor Matteucci, which has been awarded to him by the Council of the Royal Society for his important discoveries in the magnetic electricity of animal nature.

These discoveries, so singular and so new in themselves, appear to promise results of the highest importance, not only in theoretical science, but also in its practical application to the relief of pain and the cure or alleviation of disease. Whatever may, however, be their ultimate result, the scientific world must ever retain the liveliest sense of the merits of Signor Matteucci, and must ever consider him as adding new lustre to the glory that a Galvani has already given to their common country.

Mr. Christie,

I have to beg that you will take charge of the Medal for Mr. Boole, awarded to him for his important papers on a General Method of Analysis, published in our Transactions for the present year, containing matter as useful as it is original, and classifying and comprehending analytical operations*. That Mr. Boole will continue

* The object which the author proposes in this paper is to illustrate the importance of conducting processes of reduction through the medium of separation of symbols by the assumption of an exponential form for the principal quantity operated on. The method, therefore, consists in the transformation of given forms, from x to θ, by means of the relation $x = e^{\theta}$, and operating on the results by certain refined processes. Although the facilities which the exponential form affords, under certain circumstances, have long been known to analysts, in no investigation does the importance of this form appear in the manner in which it is exhibited in this paper. Here the author has shown a method which classifies and comprehends operations, and which has the advantage (in some cases at least) of showing their limits.

The author applies his method to the solution of differential equations and of equations of differences. In the finite solution of differential equations, the beauty and utility of the method are strikingly exhibited. Certain forms of equations, the solutions of which have been effected by transformations or by a happy assumption, are made, by the author's method, to exhibit their solutions in dependence on a law. Both the processes by which the transformations are effected and the results obtained by them are of the highest interest and importance; and this part of the paper is so valuable, that, alone, it would entitle the author to honorary distinction.

In the application to equations of differences, under which head are included generating functions, series, and the author's miscellaneous theorems, the advantages of a general method must likewise be fully recognised; and the Council are satisfied that the author has done good service in the applications which he has made of his method in this branch of analysis.

Anticipating that Mr. Boole's method will find a permanent place in the science, the Council have not hesitated to award to him the Royal Medal.

his mathematical pursuits must be the wish of every friend of science.

Dr. Andrews,

I have the honour of presenting to you one of the Royal Medals, which has been adjudged to you for your valuable paper on the Thermal Changes accompanying Basic Substitutions*. I hope this will not be the last on chemical subjects that we shall receive at your hands.

Since our last Anniversary we have lost many distinguished members of our Society, of whom the usual obituary will contain a short account; among these we have to regret the death of Sir Henry Halford, who for so long a period presided over the College of Physicians; and of Dr. Hope, who for very many years was Professor of Chemistry in the University of Edinburgh. We have still more immediate reason to lament the decease of one of our ablest and most zealous colleagues,—of that distinguished astronomer the late Mr. Baily, who has always taken an active share in the business as well as in the scientific pursuits of the Royal Society. We have also to deplore the death, at a venerable age, of Dr. Dalton of Manchester, whose eminent discoveries have so largely contributed to

* The Royal Medal in Chemistry is awarded to Dr. Andrews of Belfast, a chemical investigator of acknowledged ability and accuracy. He may be said to have first opened the subject of the *Heat evolved in Chemical Combinations*, by a valuable paper published three years ago in the Transactions of the Royal Irish Academy, which was followed by a second, and attracted to the inquiry the attention of the French Academy, who lately proposed it as the subject of the great Monthyon prize, with special reference to the experiments of Dr. Andrews contained in these papers.

One of the most important general results of the former papers was, that the heat on uniting a particular base or metallic oxide with an acid is constant, although the acid be varied. This result was brought out by using dilute solutions, and is certainly established in a considerable number of acids within that degree of accuracy which thermal experiments appear to admit of.

In such neutralizations of an acid by a base, it is well known that what really happens is not the simple and direct combination of the acid and base, but the displacement of the basic water of the acid by a more powerful base. Hence Dr. Andrews is led, in the paper in our Transactions which is rewarded by the Medal, to inquire, whether, in the displacement of other bases than water, such as lime, oxide of copper, &c., the same law holds. He employed potash as the displacing base, and found that the sulphate, nitrate, acetate and chloride of copper, when decomposed by that base, all evolve the same heat; or that the heat is determined by the base, and not by the acid. The experiments are very numerous, embracing the principal magnesian oxides, also soda, ammonia and peroxide of iron; and the results accord with the general conclusion.

This extension or generalization of his former law is possessed of much chemical interest, and is the first great step in a line of inquiry of which the further pursuit is greatly to be desired, from the light which it may be expected to throw upon the fundamental laws of chemical combination.

our chemical knowledge and to the scientific reputation of England.

Sir Henry Halford, Bart., G.C.H., was the son of Dr. James Vaughan of Leicester, and was born on the 2nd of October 1766. He received his preliminary education at Rugby, and graduated at Christ Church College, Oxford, in the year 1794. He established himself as physician in London, and quickly rose to great eminence in his profession. Distinguished no less by the elegance of his manners than by the extent of his classical acquirements, his practice rapidly increased, and he soon became the favourite physician of the court and of the elevated circles of rank and fashion. In 1809 he came into possession of an ample fortune on the death of Sir Charles Halford, a cousin of his mother, who was a daughter of Lord St. John, and in consequence of this acquisition he changed his name from Vaughan to Halford, a baronetcy being at the same time conferred upon him by George the Third, who had previously appointed him his physician. He continued to hold a similar appointment under George the Fourth, William the Fourth, and her present Majesty, and thus enjoyed the remarkable distinction of having possessed the confidence of four successive sovereigns, and of having attended professionally almost every member of the Royal Family.

To the honours thus emanating from royal favour were added the highest which the members of his own profession could confer. Sir Henry Halford was elected President of the College of Physicians in the year 1820, and held this office till his death, which happened in the month of March of the present year. His constitution was naturally robust, and its vigour was sustained unimpaired to an advanced period of life; but in later years the advance of age had become perceptible, his activity declined, and his constitution at last sank, in the 78th year of his age, under the exhaustion consequent on a neuralgic affection.

He was elected Fellow of the Royal Society in 1810; he contributed no paper to our Transactions, but has enriched those of the College of Physicians with numerous valuable essays on professional subjects. His orations pronounced before the College are remarkable for the classical purity and elegance of their latinity.

Francis Baily, Esq.—It is with a feeling of sorrow, in which I know that every Fellow of the Royal Society will participate, that I have to notice the irreparable loss of our distinguished colleague Mr. Francis Baily.

The memoir of Mr. Baily, which has been drawn up by Sir J. Herschel, and which is now in the press, will contain so full an account of his personal history and so elaborate an analysis of his various scientific labours, that I feel that I should do injustice to my subject if I attempted to sketch a character which he has painted with so much warmth and fullness of colouring, and with such characteristic accuracy of outline and detail; and it is only with refer-

ence to his connexion with the Royal Society that I will venture to say a very few words.

Mr. Baily was for several years Treasurer of our Society, and generally held a seat in our Council, and was rarely absent from its meetings. We are greatly indebted to him for much of the order and system which prevail in our finances; and upon every subject connected with our administration his opinion was always listened to with the respect and attention which was due to his excellent temper, good sense and judgement. On questions of science he never spoke when his knowledge of the subject did not entitle him to speak with authority, and various as were the scientific researches in which he was engaged, he never undertook a task which he did not execute with extraordinary promptitude, completeness and accuracy; so correct was the estimate which he had formed of the extent of his own powers; so persevering and systematic was his industry.

Dr. Thomas Charles Hope was the son of Dr. John Hope, Professor of Botany in the University of Edinburgh, and was born at Edinburgh on the 21st of July 1766.

His devotion to chemical science and his recognition as a chemist date from an early period of his life; for he was, on the death of Dr. Irvine, appointed Lecturer on Chemistry at Glasgow on the 10th of October 1787, while yet in his twenty-first year. He was farther, in 1789, appointed Professor of Medicine in the same university, conjointly with his uncle Dr. Stevenson. It does not appear, however, that he had actually delivered lectures on either subject in Glasgow until 1793; he most probably passed the interval in studying at home and abroad, for we are informed that he returned from France in 1791, and he thereafter continued to lecture at Glasgow until 1795. At this period, he received the distinguished compliment of being recommended by Dr. Black as his assistant and successor in the chemical chair at Edinburgh. Accordingly, in 1795, Dr. Hope entered on his new duties by delivering a course conjointly with Dr. Black, whose decaying powers permitted him only to deliver the lectures on Caloric. In this, as well as in the courses of chemistry which he delivered in Glasgow, Dr. Hope taught the then recent doctrines of Lavoisier, which had not yet entirely overthrown the doctrine of phlogiston, and had not previously been publicly taught by any professor in Britain.

Dr. Hope's exertions during his residence at Glasgow had not been limited to writing and improving his lectures. On the 4th of November 1793, he read to the Royal Society of Edinburgh his well-known paper, "On a mineral from Strontian," in which he pointed out the existence of an undescribed earth, distinct from barytes, with which it had been confounded, and to which he gave the name of *Strontites*.

In 1803, in the 6th volume of Nicholson's Journal, a brief notice was published of the instrument with which Dr. Hope employed a solution of sulphuret of potassium for eudiometrical purposes; and in 1804, he laid before the Royal Society of Edinburgh the careful

and elegant experiments, by which he demonstrated that the proposition laid down by Dr. Croune in 1683 regarding the expansion of water by cold is really correct; and that the phenomena observed do not depend, as Hooke and others had maintained, on changes occurring in the capacity of the vessel in which the experiment is conducted. From these researches, Dr. Hope concluded that the maximum density of water is at 39½° or 40° Fahr.; a result confirmed by the more recent and very accurate experiments of Hällström, who estimates its point of greatest density at 39·39° Fahr. This, his favourite subject, received a still further elucidation from him at a later period of his life. In 1839 he read to the Royal Society of Edinburgh a paper, in which he showed that this law held true with regard to water only in its pure state; and that when it contains saline matters in solution, as in sea-water, it follows the ordinary law of regularly progressive expansion by heat and contraction by cold.

The last communication which Dr. Hope made to the chemical world was in 1843, when he read two papers on the colouring matter of the *Camellia japonica*, *Magnolia-grandiflora*, and *Chrysanthemum leucanthemum*. In these communications, he asserted the existence of three new proximate organic bodies, to which he gave the names of *Camelline*, *Magnoline* and *Leucanthemine*, but which he did not obtain in a separate form.

Dr. Hope's claims on the gratitude of the chemical world are not to be estimated by his merits as an observer. He seems, from the first, to have resolved to devote himself rather to the business of teaching than of research. He spared no pains to make his lectures attractive to the student; his style of writing was elegant and concise, and his delivery easy but impressive. The great charm of his lectures, however, consisted in the elegant experiments with which he illustrated them: these were so well-devised, so skilfully arranged and so neatly performed, that a failure on his lecture-table was an occurrence almost unknown. One other circumstance which contributed to his success as a lecturer was the excellent health which he enjoyed. During a period of nearly sixty years, in which he was engaged in studying or teaching medicine and chemistry, he was not more than six days in all prevented by illness from discharging his duties. He retained his vigour and his faculties with little diminution till within a short period of his death; but in 1843, finding himself unequal to the duties of his class, he arranged with his colleague Dr. Traill to deliver the lectures for him, and shortly after resigned the appointment into the hands of the patrons.

Dr. Gregory was appointed to the vacant chair, and before he had entered on its duties his veteran predecessor died at Edinburgh on the 13th of June 1844, in the 78th year of his age.

Captain Basil Hall, R.N., was one of the younger sons of the late Sir James Hall of Dunglass.

Sir James was himself a man of very active mind, and is well known to all geologists for the experiments instituted by him in cor-

roboration of the opinion of his illustrious friend Professor Playfair, and his ingenious speculations on the origin of pointed architecture must be equally well known to the mediæval antiquary. Sir James was for some years President of the Royal Society of Edinburgh, and it may well be supposed that our late fellow inherited his father's love for science in general, and more especially for those sciences with which the naval profession has so much to do. He was born on the last day of the year 1788, and entered on his professional career in the month of June 1802. He commanded the Lyra at the time when Lord Amherst was sent on a mission to the court of Pekin, and published an interesting account of his visit to Loo-Choo. He was author of observations on a comet at the time when he was on the South American station, and of a paper on the geology of the Cape of Good Hope at an early period of his life. His favourite science was astronomy; but geology could not be indifferent to the son of Sir James Hall. He was always most anxious to serve science by receiving the instructions of distinguished philosophers, and recording for their use observations made by him in the distant parts of the world which he had the opportunity of visiting. He was an able observer and practical astronomer, and had occasion to turn these qualities to excellent account as a naval officer. He was author of many works of great interest, chiefly connected with what he had himself seen in different parts of the globe. He married Miss Hunter on the 1st of March 1825, and left a family at his death.

Admiral Sir Robert Barlow was born in the year 1758, and attained the rank of captain in the Royal Navy in June 1793. His naval career was distinguished by eminent services; and on the 24th of January 1823, he was promoted to the rank of rear admiral on the retired list, by reason of his holding the situation of Commissioner of the Navy, to which he had been appointed in the year 1808. He had the honour of being made a Knight Commander of the Bath on the first establishment of that order in its present shape, and received a Grand Cross by seniority the year before his death. He expired on the 11th of May 1843, at the advanced age of 85. By an accidental omission, his name was not mentioned in the obituary of last year.

Sir Gore Ouseley, G.C.H., was born in 1770, and was second son of Ralph Ouseley, Esq., by his first wife, the daughter of Henry Holland, Esq., of Limerick. He went to India in early life, and there displayed that aptitude for the acquirement of Eastern languages to which he was mainly indebted for his subsequent political advancement. After his return, he married, in 1806, Miss Whitelock, by whom he left the son who has succeeded him in his hereditary honours. His useful services as a Persian linguist at the time when a Persian envoy had visited our shores, procured for him the post of ambassador at the court of Persia in 1810. He afterwards proceeded to St. Petersburg. He was created a privy councillor

and a baronet, and he was also invested with the Russian order of Alexander, and the Persian order of the Lion and Sun. His gentlemanly address and the agreeableness of his manners rendered him a general favourite in society. He died at his seat, Hall Barn Park, on the 18th day of the present month, in the 75th year of his age, and is succeeded in his title and estates by his son Frederick Arthur Gore, the present baronet, who was born in the year 1825.

JOHN DALTON was born on the 5th of September, 1766, at Eaglesfield, near Cockermouth, in the Cumberland Lake district. He passed some years as teacher of mathematics in a school at Kendal, and removed in 1793 to Manchester, where he continued to reside during the whole of his after-life.

It was doubtless his long residence among the lakes and mountains of Cumberland, and his consequent early familiarity with the ever-varying conditions of the atmosphere observable in that district, that gave the first impulse to his genius, and materially influenced his subsequent scientific career. His earliest important publication was a Treatise on Meteorology, which furnished a clear compendium of all the facts then ascertained, and made known various original views, especially on the altitude of the Aurora Borealis. From observing and recording the sensible atmospheric changes, the phenomena of dew, of clouds and of temperature, he was naturally impelled to inquire into the constitution of the atmosphere, and more generally of mixed elastic fluids, and into the theory of evaporation and the laws of heat. On these questions he made public, through the Transactions of the Manchester Society, a series of experimental memoirs, of which it is impossible to over-estimate the importance. His first conception of the mutual relations of mixed gases was, that each gas stood in the relation of a vacuum to the particles of all other gases; but in his New System of Chemical Philosophy he subsequently relaxed the strictness of this original proposition, by conceding that the particles presented some mechanical impediment to commingling. He ascertained the form of the vapours of water and some other liquids at different temperatures, and dispelled by these experiments and others of equal importance the obscurity in which the theory of vaporization had been left by De Luc and Saussure. He first showed that a given space, whether void or filled with any gas, in contact with water, contains precisely the same amount of aqueous vapour, and thus established the non-existence of chemical affinity between the gas and the steam of water. It is impossible not to be impressed with the beautiful simplicity of the instruments by which these important results were wrought out. Four barometric tubes, filled with mercury, over which were admitted small columns of water, alcohol, ether and sulphuret of carbon, were the means employed for the admeasurement of the comparative forms of the vapours at different atmospheric or artificial temperatures. Among these successive memoirs is one of great merit on the heat evolved during the entrance of air into a vacuum. He showed the inadequacy of the thermometer to serve as a measure of this evanescent

elevation of temperature, and by an ingenious contrivance obtained a much closer approximation to the true heat.

The first part of his New System of Chemical Philosophy will probably constitute the most durable monument of his scientific genius; in this small volume are condensed the results of many years' patient thinking and of much laborious research; those larger portions, which are devoted to the measure of temperature and the theory of specific heat, may still be studied with advantage, though they were deemed by Dr. Dalton himself to have been in great part superseded by the labours of MM. Petit and Dulong. The short concluding chapter contains the first announcement of the atomic doctrine of chemical combination.

He has often expressly stated that the tables of chemical equivalents constructed by Wenzel and Richter first suggested to him the conception that chemical combination must have place between the ultimate particles or indivisible atoms of bodies. The tabulated differences of weight of the different bases required to neutralise a given weight of acid would, on this hypothesis, represent the respective weights of their ultimate atoms. Further evidence of more decisive character presented itself in the instances in which one body combines with another in more than one proportion. The successive combining quantities were ascertained to be represented by numbers that were simple multiples of the smallest or lowest quantity. Dr. Dalton's earliest illustration of his law of multiple proportions was derived from the gaseous compounds of oxygen and nitrogen. Dr. Wollaston afterwards discovered other examples of the law in the tartrates and oxalates, and M. Gay Lussac's precise experiments on gaseous combination completed the chain of evidence. All the phenomena of inorganic chemistry have been since shown to be in strict accordance with the atomic hypothesis, which has banished the uncertainty of conflicting results, by enabling the experimentalist to anticipate and correct his analyses, and has thus raised chemistry, as respects numerical precision, almost to the rank of a mathematical science.

It would be inconsistent with the principles of logical induction to claim for the atomic doctrine higher rank than that of the most convenient form of expressing and recording chemical phenomena, and of the most probable hypothesis that has been hitherto proposed for interpreting chemical combination. In the field of organic analysis, which has of late years been laboured with signal success, rules of combination seem to obtain which are difficultly reconcileable with the doctrine of Dalton. It is scarcely possible to conceive the mechanical juxtaposition of so large a number of elementary atoms as would appear to constitute one compound organic atom; there are consequently many among the cultivators of this branch of chemical science who refuse to accept the atomic hypothesis as now constituting a sufficient generalization of established facts. Yet even in the chemistry of vegetable substances, the remarkable changes discovered by Mitscherlich, which he conceives best explained by the union of propejacent atoms of hydrogen and oxygen, and their elimi-

nation in the form of water, minister strong support to the theory of atomic combination. Without venturing to anticipate the future destinies of the hypothesis of Dalton, it is sufficient for the fame of its author to acknowledge the mighty impulse it has given to the progress of chemical knowledge.

Dr. Dalton died on the 27th of July last.

Thomas Henderson, Professor of Practical Astronomy in the University of Edinburgh, and Her Majesty's Astronomer for Scotland, was born at Dundee on the 28th of December 1798, and received a competent classical and mathematical education at the excellent public schools of that town. He was intended for the legal profession, and at the age of fifteen was placed in the office of a solicitor in Dundee, where he continued six years. During this period he began, without any other assistance than such as he could derive from books, to devote his leisure time to the study of astronomy, and being gifted with a quick apprehension and extraordinary powers of memory, he very soon made himself acquainted with the practical parts of the science, and acquired great dexterity in astronomical computations. At the age of twenty-one he removed to Edinburgh, for the purpose of completing his legal education, and some time afterwards he was employed as private secretary to the Earl of Lauderdale. In Edinburgh his knowledge of astronomy procured him the acquaintance of some of the most eminent professors and scientific characters of that metropolis, whose encouragement no doubt tended to stimulate his efforts and confirm his tastes; and in the small observatory belonging to the Astronomical Institution he had an opportunity of becoming acquainted with the use of instruments. That he used his opportunities to good purpose is apparent from the communications he now began to make to the Royal Astronomical Society, both of observations made by him at Edinburgh and of various useful calculations, relating chiefly to moon-culminating stars, but extending also to other phenomena; and at the anniversary meeting of that body in 1830 he received their thanks for "the very valuable assistance which he had rendered to the cause of astronomy in his various computations presented to the Society." His connexion with Lord Lauderdale brought him occasionally to London, where his contributions to the Astronomical Society secured him a favourable reception from astronomers, and the high opinion which had been formed of his talents was confirmed by personal intercourse and observation of the extent and remarkable accuracy of his astronomical knowledge. In October 1831 he was appointed to succeed Mr. Fallows as astronomer at the Cape of Good Hope. Causes of a nature entirely personal led to his resignation of this appointment at the end of about a year after he had entered on its duties; but though the time of his residence at the Cape was short, it was most diligently employed, and sufficed for accumulating a mass of important observations, from which he afterwards deduced results of great value to astronomy. In August 1834 he was appointed, on the recommendation of the Royal Astronomical Society

(whose advice had been requested by the Secretary of State), to the Professorship of Practical Astronomy in the University of Edinburgh, with which office was conjoined the superintendence of the Edinburgh observatory, then taken under the protection of the Government. This appointment he continued to hold till his death, which took place after a short illness, in consequence of an affection of the heart, on the 23rd of November 1844, before he had quite completed his 46th year.

Professor Henderson's reputation as an astronomer stood high; he was a careful and accurate observer, an expert and resolute calculator, was profoundly skilled in the theory of instruments, and possessed great knowledge of methods, and an acquaintance with the history and literature of his science, which for extent and minute accuracy has rarely been surpassed. The results of his labours were for the most part communicated to the Royal Astronomical Society, and have been printed in their Memoirs: they embrace a considerable range of subjects, but the most important perhaps, in point of permanent value, is his Catalogue of the Declinations and Right Ascensions of 172 principal Fixed Stars (chiefly in the southern hemisphere), observed by himself and his assistant during his residence at the Cape; and the most remarkable of the single results he obtained is a sensible parallax of the double star α Centauri, amounting to about one second of space: this result, which he first detected on a comparison of his reduced observations of declination, was partially confirmed by the subsequent reduction of the observations of the star's right ascensions; and it afterwards received from him a further confirmation by a discussion of the observations made by his successor Mr. Maclear, expressly with a view to the determination of the question. Having regard to the history of this subject, it would perhaps be unsafe at present to affirm that he has done more than establish a strong probability in favour of the measureable parallax of this system (already remarkable for its great proper motion); but should further observations change the probability into a certainty, Mr. Henderson's name will descend to posterity associated with a discovery which has so long been the desire of astronomers, and so often baffled their efforts. His whole astronomical career was marked by an activity and energy which continued unabated to the last. Nor were his labours confined to the routine of his official duties. On more than one occasion he cheerfully undertook the heavy task of giving lectures for his colleagues in the University; much of his time was consumed in the reduction of his Cape observations; he superintended the reduction and arrangement of La Caille's Catalogue for the British Association; and if a comet was anywhere observed, he was always one of the first to compute and communicate its orbit.

In his private character Mr. Henderson was distinguished by great kindness of disposition, amiable manners, and warmth of affection; he was an enthusiastic admirer of excellence of every kind, and a person on whose integrity, honour and high principles, every one who had the good fortune to enjoy his acquaintance felt that the

most implicit confidence might be placed. He was a Fellow of the Royal Astronomical Society and of the Royal Society of Edinburgh, and was elected into this Society on the 9th of April 1840.

William Allen was the son of Mr. Job Allen, a silk-manufacturer of Spitalfields, and was born in London on the 29th of August 1770. His father being of the Society of Friends, he was strictly educated in the principles of that religious community, of which he continued till his death an exemplary and distinguished member. The early preference evinced by him for chemistry induced his father to place him in an establishment of high repute, of which, some years after, he became the proprietor. But happily for suffering humanity, neither commercial gains nor the love of science itself could hold exclusive possession of his mind. From an early period of his life he cooperated with Clarkson, Wilberforce and other philanthropists in their efforts for the abolition of the African slave-trade, which were happily at length successful.

Mr. Allen's connexion with the schools of chemistry and natural philosophy in Guy's Hospital commenced in 1803, and continued till 1826: Mr. Allen's ability and fitness as a teacher of science were there amply attested.

In 1804, Mr. Allen read his first course of lectures on natural philosophy in the Royal Institution. The valuable researches on carbon, carbonic acid, and the changes effected in atmospheric air by respiration, made by Mr. Allen in conjunction with Mr. Pepys, are too well known to require remark. The results are to be found in our Transactions for 1807, 1808, 1809. Mr. Allen was in 1807 admitted a Fellow of the Royal Society. He also became a member of other scientific bodies of this country and of the continent.

It was, however, to other objects of public utility that the greater part of Mr. Allen's life was devoted. The education of the poor on christian principles, and the circulation of the holy scriptures, were among the first to which he directed his efforts; and wherever he went the moral improvement of his fellow-creatures occupied his attention. He was at all times ready to cooperate with the good of every creed whose aim was the happiness of mankind, and probably no man of his generation lived to see nobler fruits of his labours.

Having been one of the founders of the British and Foreign School Society, he was, in 1808, elected its first treasurer, an office which he held until his death. To this institution he liberally contributed not only his time, but also large pecuniary assistance. At Lindfield, in Sussex, he expended large sums in building schools of industry, and laboured assiduously by other plans for bettering the condition of the poor. Among these the system of allotments of land found him a zealous patron.

In 1818–19 Mr. Allen visited Russia, where, in the reign of the Emperor Alexander, he, in conjunction with two friends, compiled a volume of scriptural selections, for the instruction of youth in the military and other schools of that empire. Mr. Allen made several other journeys for benevolent objects to the continent, and he greatly

exerted himself in behalf of the Greeks and of the Waldenses of Piedmont.

The source of Mr. Allen's extraordinary influence was to be found in that singleness of purpose, which, breaking down the obstacles of party, gave him access to those in power, and carried him as by a royal road to the confidence and favour of princes. At home we find him enjoying the marked consideration of their late Royal Highnesses the Dukes of Kent and Sussex, the former appointing him one of his executors; and abroad he was in frequent communication with the Emperor Alexander.

Mr. Allen possessed in an uncommon degree the power of giving his mind to a great variety of subjects, and this, together with his activity, economy of time and early habits, enabled him to accomplish a prodigious amount of good. His correspondence alone was a labour from which most men would have shrunk.

In addition to subscriptions and donations to public charities, the casual calls on Mr. Allen's benevolence were very heavy; he also gave cheerfully, and there are perhaps few great works which he did not at some period of his life assist. The extent of Mr. Allen's charity seems to have been widely known, for we find the Emperor Alexander urging it as a reason for his undertaking the supply of drugs for the Russian armies, an offer which he gratefully but firmly refused, and to his honour be it spoken, he resisted a temptation the value of which it would be difficult to estimate. At the end of a long life he could say that he had never compromised his public usefulness for private interests.

During the last fourteen years of his active life, Mr. Allen had passed about half his time at Lindfield, diffusing happiness and doing good to those about him. The review of a well-spent life gave comfort to the evening of his days, and that gospel which had been his rule through life was his stay in death, sustaining his mind in serenity and peace.

He died at Lindfield on the 30th of December, 1843, aged 73.

The thanks of the Meeting were given to the President for his Address, with a request that he would allow it to be printed.

The Statutes relating to the election of Council and Officers having been read by the Secretary, and Joseph Smith and Samuel Solly, Esqs. having, with the consent of the Society, been nominated Scrutators in examining the lists, the votes of the Fellows present were collected.

Dr. Roget, on the part of the Scrutators, reported the following Noblemen and Gentlemen as being duly elected Officers and Council for the ensuing year, viz.—

President.—The Marquis of Northampton.

Treasurer.—Sir John William Lubbock, Bart., M.A.

Secretaries. { Peter Mark Roget, M.D.
Samuel Hunter Christie, Esq., M.A.

Foreign Secretary.—John Frederic Daniell, Esq., D.C.L.

Other Members of the Council.—John Bostock, M.D.; William Bowman, Esq.; Isambard Kingdom Brunel, Esq.; Rev. William Buckland, D.D.; Sir William Burnett, M.D., K.C.H.; George Dollond, Esq.; Very Rev. Dean of Ely; Thomas Graham, Esq., M.A.; Roderick Impey Murchison, Esq.; Richard Owen, Esq.; Sir James Clark Ross, Capt. R.N.; John Forbes Royle, M.D.; William Sharpey, M.D.; John Taylor, Esq.; Rev. Robert Walker, M.A.; Lord Wrottesley.

The thanks of the Meeting were given to the Scrutators for their trouble in examining the lists.

The following is the statement of the Receipts and Payments of the Society during the preceding year, which was laid on the table by the Treasurer:—

Statement of the Receipts and Payments of the Royal Society between Nov. 29, 1843, and Nov. 29, 1844.

RECEIPTS.

	£	s.	d.
Balance in the hands of the Treasurer at the last Audit ..	1994	7	1
23 Weekly Contributions, at one shilling 59 16 0			
236 Quarterly Contributions at £1..... 966 0 0			
	1025	16	0
19 Admission Fees	190	0	0
1 Composition for Annual Payments at £40	40	0	0
5 Compositions for Annual Payments at £60	300	0	0
J. Stevenson, Esq., for Donation Fund.....	10	10	0
One year's rent of lands at Acton: due at Michaelmas 1844 ..... 70 0 0			
New land marks 25 3 0			
2½ years' Income Tax 5 2 1			
30 5 1			
	39	14	11
One-fifth of the clear rent of an estate at Lambeth Hill, from the Royal College of Physicians, in pursuance of Lady Sadleir's will: due at Midsummer 1844	3	0	0
Dividends on Stock:—			
One year's dividend on £14,000 Reduced 3 per cent. Annuities 420 0 0			
Less Income Tax 12 5 0			
	407	15	0
Half year's dividend on £1000 3 per cent. Consols 15 0 0			
Less Income Tax 0 8 9			
	14	11	3
Carried forward	4025	14	3

	£	s.	d.	£	s.	d.
Brought forward				4025	14	3
One year's dividend on 3452*l.* 1*s.* 1*d.* Consols, the produce of the sale of the premises in Coleman-street	103	11	2			
Less Income Tax	3	0	4			
				100	10	10
One year's dividend on £200 Consols	6	0	0			
Less Income Tax	0	3	6			
				5	16	6
Donation Fund.						
One year's dividend on £4843 14*s.* 7*d.*	145	6	2			
Less Income Tax	4	4	10			
				141	1	4
Rumford Fund.						
One year's dividend on 2292*l.* 11*s.* 7*d.* Consols	68	15	6			
Less Income Tax	2	0	0			
				66	15	6
Fairchild Fund.						
One year's dividend on £100 New South Sea Annuities				3	0	0
Sir Clifton Wintringham's Bequest.						
One year's dividend on £1200 Consols	36	0	0			
Less Income Tax	1	1	0			
				34	19	0
Miscellaneous Receipts:—						
Sale of Philosophical Transactions, Abstracts of Papers, and Catalogues of the Royal Society's Library				226	0	9
Total Receipts				£4603	18	2

PAYMENTS.

	£	s.	d.	£	s.	d.
Fairchild Lecture.—The Rev. J. J. Ellis, for delivering the Fairchild Lecture for 1844				3	0	0
Bakerian Lecture.—Richard Owen, Esq., for the Bakerian Lecture for 1844				4	0	0
Books purchased:	£	s.	d.			
Dulau and Co.: for Books	13	0	3			
Baillière: for ditto	21	8	6			
Nutt: for ditto	4	7	6			
Taylor: for ditto	3	12	0			
Maynard: for ditto	4	4	0			
				46	12	3
Carried forward				53	12	3

	£	s.	d.	£	s.	d.
Brought forward				53	12	3
Salaries:—						
Dr. Roget, one year, as Secretary	105	0	0			
S. H. Christie, Esq., one year, as Secretary	105	0	0			
Ditto for Index to Phil. Trans.	5	5	0			
John F. Daniell, Esq., one year, as For. Sec.	20	0	0			
Charles R. Weld, Esq., one year, as Assistant-Secretary and Librarian	200	0	0			
Mr. White, half a year, as Attendant	40	0	0			
G. Holtzer, one year, as Porter	30	0	0			
Ditto, for extra Porterage	10	0	0			
				515	5	0
Purchase of £1000 3 per cent. Consols				972	10	0
Fire Insurance, on the Society's Property				45	1	6
Mrs. Coppard: Gratuity				10	0	0
Mr. Shuckard: Gratuity				25	0	0
Clerks: Christmas Fee				1	1	0
Bills:—						
Taylor:						
Printing the Phil. Trans., 1843, part 2	177	16	6			
Ditto, 1844, part 1	53	11	0			
Ditto, Proceedings, Nos. 55—57; Circulars, Lists of Fellows, Ballot-lists, Statement of Payments, and Minutes of Council; &c. &c.	84	9	6			
				315	17	0
Bowles and Gardiner:						
For Paper for the Phil. Trans., 1843, part 2, and 1844, part 1	76	16	0			
	29	8	0			
				106	4	0
Basire:						
For Engraving and Copper-plate printing for Phil. Trans., 1844, parts 1 and 2, &c.				124	14	4
Gyde:						
Boarding and Sewing 800 Parts of Phil. Trans., 1843, part 2	27	6	8			
Ditto, 1844, part 1	28	3	4			
				55	10	0
Executors of T. R. Robinson:						
For Magnetometer	26	5	0			
Tuckett:						
Bookbinding	32	15	4			
Pouncey and Sons:						
For Stationery	2	10	9			
Saunderson:						
For Shipping Expenses	10	17	9			
Carried forward	72	8	10	2224	15	1

	£	s.	d.	£	s.	d.
Brought forward....	72	8	10	2224	15	1
Brecknell and Turner:						
Candles, and Lamp Oil	11	1	6			
Arnold:						
For Coals	23	4	0			
Ditto (Porter's yearly allowance)	4	7	0			
Edis:						
For making Cupboard	3	14	0			
Shoolbred:						
For Moreen	3	4	1			
Tress:						
For Map	3	3	0			
Gwillim:						
Mats, Brushes, Fire-wood, &c.	4	18	7			
Snell:						
For Carpets and Repairs	57	6	5			
Cubitt:						
For repairs and relaying Carpets, &c.....	21	13	5			
Luck, Kent and Co.:						
Carpets	27	3	5			
Mr. C. Gyde:						
For Services as Clerk.....	9	0	0			
				241	4	3
Law Expenses:						
Proportion of Costs for Defending Mablethorpe Tithe Suit	83	9	10			
Proportion of Expenses for Commutation of Tithes at Acton	7	17	6			
				91	7	4
Taxes and Parish Rates:						
Land and Assessed Taxes	21	14	2			
Income Tax	4	19	2			
				26	13	4
Petty Charges:						
Charwoman				2	12	6
Postage and Carriage.....	13	5	1			
Expenses on Foreign Packets, &c.	11	8	10			
Stamps	0	19	0			
Charwoman's Wages.....	25	14	6			
Ditto, Extra work	2	0	0			
Miscellaneous expenses	23	5	7			
				76	13	0
Balance in the hands of the Treasurer				1940	12	8
			Total....	£4603	18	2

JOHN W. LUBBOCK, *Treas.*

November 29th, 1844.

BRITISH MUSEUM FUND.

Dr.				*Cr.*			
1839.				1839.			
Dec. 1. To Balance ..	203	14	4	Dec. 1. By Books....	38	2	6
				By Balance ..	165	11	10
	£203	14	4		£203	14	4
1840.				1840.			
Dec. 1. To Balance ..	165	11	10	Dec. 1. By Books....	111	1	6
				By Balance ..	54	10	4
	£165	11	10		£165	11	10
1841.				1841.			
Dec. 1. To Balance ..	54	10	4	Dec. 1. By Books....	54	10	4

The Balances in hand, now belonging to the several trusts, are as under: viz.—

	£	*s.*	*d.*
Donation Fund	172	17	3
Rumford Fund	133	11	0

The following table shows the progress and present state of the Society with respect to the number of Fellows:—

	Patron and Honorary.	Foreign.	Having compounded.	Paying £2 12*s.* Annually.	Paying £4 Annually.	Total.
November 1843....	12	49	521	23	226	831
Since elected.....	+ 1		+ 5	.....	+ 14	+20
Since compounded	.....	.....	+ 1	.....	− 1	
Defaulters	.....	.....	.....	.....	− 1	−1
Since deceased			− 20	− 1	− 5	−26
November 1844....	13	49	507	22	233	824

Weekly and Quarterly Contributions.

1830	£363	4	0	1838	£599	4	0
1831	286	0	0	1839	666	16	0
1832	255	6	0	1840	767	4	0
1833	283	7	6	1841	815	12	0
1834	318	18	6	1842	910	8	0
1835	346	12	6	1843	933	16	0
1836	495	0	0	1844	1025	16	0
1837	531	0	0				

December 12, 1844.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

"On the Laws of the Tides on the Coast of Ireland, as inferred from an extensive series of observations made in connexion with the Ordnance Survey of Ireland." By George Biddell Airy, Esq., F.R.S., Astronomer Royal.

The elaborate investigations of which the results are communicated in the present paper, were suggested by the necessity of adopting some standard mean height of the sea, as a line of reference for the elevations ascertained in the operations of the Ordnance Survey of Ireland. Colonel Colby, R.E, who conducted that survey, had with this view determined to institute a series of observations on the height of the water in different states of the tide; and conceiving that these observations might be made subservient to improvement in the theory of the tides, requested the assistance of the author in laying down the plan of observation best calculated to effect that object. The suggestions which were, in consequence, made by the author were adopted in their utmost extent by Colonel Colby; and the collection of observations was placed in the author's hands in the winter of 1842. The whole number of observations exceeds two hundred thousand; and they derive extraordinary value from the circumstance of the localities, of their simultaneity, their extensive range, and the uniformity of plan on which they were conducted. Their reduction was made by the computers at the Royal Observatory, Greenwich, under the superintendence of the author, and with the authority of the Lords Commissioners of the Treasury. The nature of the different branches of the inquiry may be gathered from the titles of the several sections into which the paper is divided, and which are as follows:—

Section I.—Account of the stations, levellings, times and methods of observation.

Section II.—Methods of extracting from the observations the times of high and low water; of supplying deficient times and heights; and of correcting the times first determined.

Section III.—Theory of diurnal tide as related to observations only; and deduction of the principal results for diurnal tide given immediately by these observations.

Section IV.—Theory of diurnal tide as referred to the actions of the sun and moon.

Section V.—Discussion of the height of apparent mean water, as deduced from the heights of high and low water only, corrected for diurnal tide; with reference to difference of station, and to variations of the phase of the moon, and of the declination of the moon.

Section VI.—Discussion of the range of the tide, and of semimenstrual inequality in height, apparent proportion of solar and lunar effects as shown by heights, and age of tide as shown by heights, from high water and from low water.

Section VII.—Establishment of each port, and progress of semidiurnal tide round the island.

Section VIII.—Semimenstrual inequality in time, proportion of solar and lunar effects as shewn by times, and apparent age of tide as shown by times, from high water and from low water.

Section IX.—Formation of the time of diurnal high water; progress of the diurnal tide-wave round the island; comparison of its progress and range with those of the semidiurnal tide.

Section X.—Method of expressing the height of the water throughout every individual tide, by sines and cosines of arcs; and expressions in this form for every tide in the whole series of observations, except those at Courtown.

Section XI.—Discussion of the height of mean water deduced from the analysis of individual tides; with reference to difference of station, and to variations of the phase of the moon, and of the declination of the moon.

Section XII.—Discussion of range of tide, or coefficient of first arc, in the analysis of individual tides; and of semimenstrual inequality in range, apparent proportion of solar and lunar effects, and age of tide as deduced from range.

Section XIII.—Establishment of each port, as deduced from the time of maximum of the first periodical term in the analysis of individual tides.

Section XIV.—Semimenstrual inequality in time, proportion of solar and lunar effects from times, and apparent age of tide as shown by times, deduced from the time of maximum of the first periodical term.

Section XV.—Comparison of the results as to mean height, range, semimenstrual inequality in height, age of tide obtained from height, establishment, semimenstrual inequality in time, and age of tide obtained from time, deduced from high and low waters only, in Sections V., VI., VII., VIII., with those deduced from the analysis of individual tides in Sections XI., XII., XIII., XIV.

Section XVI.—Remarks on the succeeding terms of the expressions for individual tides, as related to the magnitude of the tide, to the position on the sea-coast, to the position on the river, &c.; comparison with the terms given by the theory of waves; discussion of the quarto-diurnal tides.

Section XVII.—Separate discussion of the tidal observations at Courtown.

Section XVIII.—Examination into the question of tertio-diurnal tide.

January 16, 1845.

SIR JAMES CLARK ROSS, V.P., in the Chair.

"On the Liquefaction and Solidification of Bodies generally existing as Gases." By Michael Faraday, Esq., F.R.S., D.C.L., &c.

The method employed by the author for examining the capability of gases to assume the liquid or solid form, consisted in combining the condensing powers of mechanical compression with that of very

considerable depressions of temperature. The first object was obtained by the successive action of two air-pumps; the first having a piston of one inch in diameter, by which the gas to be condensed was forced into the cylinder of the second pump, the diameter of whose piston was only half an inch. The tubes into which the air, thus further condensed, was made to pass, were of green bottle glass, from one-sixth to one-quarter of an inch in external diameter, and had a curvature at one portion of their length adapted to immersion in a cooling mixture: they were provided with suitable stop-cocks, screws, connecting pieces, and terminal caps, all very carefully made, and rendered sufficiently air-tight to retain their gaseous contents under the circumstances of the experiments, and when they were sustaining a pressure of fifty atmospheres, as ascertained by mercurial gauges connected with the apparatus. Cold was applied to the curved portions of the tube by their immersion in a bath of Thilorier's mixture of solid carbonic acid and ether. The degree of cold thus produced, when the mixture was surrounded by the air, estimated by an alcohol thermometer, was a temperature of −106° Fahr. But on placing the mixture under an air-pump, and removing the atmospheric pressure, leaving only that of the vapour of carbonic acid, which amounted only to 1-24th of the former, (that is to the pressure of a column of 1·2 inch of mercury,) the thermometer indicated a temperature of 166° below zero of Fahrenheit's scale. In this state, the ether was very fluid; and the bath could be kept in good order for a quarter of an hour at a time.

The author found that there were many gases which, on being subjected to cold of this extreme intensity, condensed into liquids, even without a greater condensation than that arising from the ordinary atmospheric pressure, and that they could then be preserved, sealed up in glass tubes, in this liquid state. Such was the case with chlorine, cyanogen, ammonia, sulphuretted hydrogen, arseniuretted hydrogen, hydroiodic acid, hydrobromic acid, carbonic acid, and euchlorine. With respect to some other gases, such as nitric oxide, fluosilicon, and olefiant gas, it was difficult to retain them for any length of time in the tubes, in consequence of the chemical action they exerted on the cements used in the joinings of caps and other parts of the apparatus. Hydroiodic and hydrobromic acids could be obtained either in the solid or liquid state. Muriatic acid gas did not freeze at the lowest temperature to which it could be subjected. Sulphurous acid froze into transparent and colourless crystals, of greater specific gravity than the liquid out of which they were formed. Sulphuretted hydrogen solidified in masses of confused crystals of a white colour, at a temperature of −122° Fahr. Euchlorine was easily converted from the gaseous state into a solid crystalline body, which, by a slight increase of temperature, melted into an orange-red fluid. Nitrous oxide was obtained solid at the temperature of the carbonic acid bath *in vacuo*, and then appeared as a beautifully clear and colourless crystalline body. The author conceives that in this state it might, in certain cases, be substituted with advantage for carbonic acid in frigorific processes, for arriving at degrees of

cold far below those hitherto attained by the employment of the latter substance. Ammonia was obtained in the state of solid white crystals, and retained this form at a temperature of −103°.

The following liquids could not be made to freeze at −166°; namely, chlorine, ether, alcohol, sulphuret of carbon, caoutchoucine, camphine, and rectified oil of turpentine.

The following gases showed no signs of liquefaction when cooled by the carbonic acid bath, even when subjected to great pressure; namely,

Hydrogen, Oxygen, at a pressure of .... 27 atmospheres.
Nitrogen and nitric oxide at a pressure of 50 atmospheres.
Carbonic oxide at a pressure of ..... 40 atmospheres.
Coal-gas at a pressure of..... 32 atmospheres.

January 23, 1845.

SIR JOHN WILLIAM LUBBOCK, Bart., V.P. and Treas. in the Chair.

1. "Observations de la Déclinaison et Intensité Horizontales Magnétiques observées à Milan pendant vingt-quatre heures consécutives le 29 et 30 de Décembre 1844." Par M. Carlini.

2. "Remarks having reference to the Earthquake felt in Demerara on the morning of the 30th of August 1844." By Daniel Blair, Esq., Colonial Surgeon of British Guiana. Communicated by the Right Honourable Lord Stanley.

The earthquake here described commenced at twenty-seven minutes past three o'clock, a.m. on the 30th of August, and continued during two or three minutes. It appeared to be composed of two waves or pulsations quickly succeeding each other, and producing gyratory movements of the earth. Though the alarm it occasioned was very great, no serious damage seems to have resulted from it.

3. "An Account of the artificial formation of a Vegeto-alkali." By George Fownes, Esq., Chemical Lecturer in the Medical School of the Middlesex Hospital. Communicated by Thomas Graham, Esq., F.R.S., Professor of Chemistry in University College.

The substance which is the subject of investigation in this paper is a volatile oil, obtained by distillation from a mixture of bran, sulphuric acid and water, and is designated by the author by the name of *furfurol*. Its chemical composition is expressed by the formula $C^{15}\,H^{6}\,O^{6}$, and its properties are the following:—When free from water and freshly rectified, it is nearly colourless; but after a few hours, it acquires a brownish tint, which eventually deepens almost to blackness. When in contact with water, or when not properly rendered anhydrous, it is less subject to change, and merely assumes a yellow colour. Its odour resembles that of a mixture of bitter almond oil and oil of cassia, but has less fragrance. Its specific

gravity at 60° Fahr. is 1·168; it boils at 323° Fahr., and distils at that temperature without alteration. It dissolves to a large extent in cold water and also in alcohol. Its solution in concentrated sulphuric acid has a magnificent purple colour, and is decomposed by water. Nitric acid, with the aid of heat, attacks the oil with prodigious violence, evolving copious red fumes, and generating oxalic acid, which appears to be the only product. It dissolves in a solution of caustic potash, forming a deep brown liquid, from which acids precipitate a resinous matter. With a slight heat, it explodes when acted upon by metallic potassium.

When placed in contact with 5 or 6 times its bulk of *Liquor ammoniæ*, it is gradually converted into a solid, yellowish-white, and somewhat crystalline mass, which is very bulky, perfectly soluble in cold water, and easily obtained in a state of dryness under a vacuum. The formula expressing the chemical constitution of this substance, or of *furfuroamide*, as the author calls it, is $C^{15}\,H^{6}\,N\,O^{3}$, and it is classed by him with the *amides*. The oil itself appears to be identical with the substance described by Dr. Stenhouse under the name of *artificial oil of ants*. Another substance, isomeric with the amides, and of which the formula is $C^{30}\,H^{12}\,N^{2}\,O^{6}$, was obtained by the author, and termed by him *furfurine*, and found to have the properties of a vegeto-alkali, and to form saline compounds with various acids.

February 6, 1845.

SIR JOHN WILLIAM LUBBOCK, Bart., V.P. and Treas. in the Chair.

"On a new Bleaching Principle produced by the slow Combustion of Æther in Atmospheric Air, and by the rapid Combustion of Bodies in a Jet of Hydrogen Gas." By C. F. Schœnbein, Professor of Chemistry in the University of Basle, &c. Communicated in a letter to Michael Faraday, Esq., F.R.S., &c.

The author, having observed that a peculiar principle, in many respects similar to chlorine, was developed during the slow combustion of phosphorus in the atmosphere, was led to inquire into the product of the slow combustion of the vapour of æther mixed with atmospheric air. He finds, that besides well-known compounds, such as aldehydic, formic and acetic acids, there is evolved a principle hitherto unnoticed, which possesses oxidizing and bleaching properties in an eminent degree. It decomposes indigo, iodide of potassium, and hydroiodic acid, and also, though more slowly, bromide of potassium. When in contact with water, it converts iodine into iodic acid, and sulphurous into sulphuric acid, changes the yellow ferro-cyanide of potassium into the red, and the white cyanide of iron into the blue; it transforms the salts of protoxide of iron into those of the peroxide; and it discharges the colours produced by sulphuret of lead. The author points out the similarity between the action of this substance, in these instances, and that of chlorine and of ozone.

Analogous results were obtained from the combustion of a jet of

hydrogen gas in atmospheric air, and even, under particular circumstances, from the flame of a common candle, and also from various other inflammable bodies when burning under certain conditions. The author is hence led to the conclusion that this peculiar oxidizing and bleaching principle is produced in all cases of rapid combustion taking place in atmospheric air, and that its production is therefore independent of the nature of the substance which is burnt.

"On the Structure and Development of the Blood.—*First Series.* The development of the Blood-Corpuscle in Insects and other Invertebrata, and its comparison with that of Man and the Vertebrata." By George Newport, Esq., F.R.C.S., President of the Entomological Society, &c. Communicated by P. M. Roget, M.D., Sec. R.S.

The author commences his paper by remarking, that he was led to the present inquiry by some curious facts relating to the blood of insects, which attracted his notice while engaged on the last paper he presented to the Royal Society, on the reproduction of lost parts in insects and myriapoda. Some of these facts he is desirous of making known at once to the Society, preparatory to his offering them more extended researches on the blood of the invertebrata, and its comparison with that of the higher animals.

The chief purpose of the author in the present paper, is to show the analogy which exists between the different corpuscles in the blood of insects and of the vertebrata, to trace the changes which the former undergo as compared with those of the latter, and to show that in development and function they are analogous to secreting cells.

In pursuance of this object, he premises a brief notice of what little was already known respecting the corpuscle in the articulata, and of the different descriptions given of it by Carus, Spence, Wagner, Bowerbank, Edwards, Baly and some later observers, all of whom have described it differently, one only, Mr. Bowerbank, having correctly indicated its form.

He then proceeds to state, that while engaged on other observations in June last, he found that the oat-shaped corpuscles, which are so abundant in the caterpillar state of the insect, almost entirely disappear before the insect has arrived at the perfect, or butterfly state, in which, a few days after the insect is fully developed, scarcely a single oat-shaped corpuscle is to be found; but in the place of these, there are numerous very minute rounded bodies, spherules, and also many flattened, obtusely oval or barrel-shaped, double concave discs. Both these forms of corpuscle have molecular movements, which are most energetic in the spherules.

He next makes some general observations on the composition of the blood of the invertebrata, and calls in question the accuracy of Professor Wagner's view in regarding the blood of these animals as analogous only to the chyle of the vertebrata, at the same time stating his belief that it is not only analogous to true blood, but that it undergoes a continued succession of changes through the agency of the corpuscles. These minute bodies first derive nourishment and

the means of growth and increase from the fluid portion of the blood; and afterwards, when they have become fully developed, undergo dissolution, and help to supply the waste of the fluid that has been expended on the nourishment of the different structures, leaving other little bodies, which also undergo development, to assist in the further elaboration of this fluid. He states also, that the development of these latter bodies appears to have a certain relation to the type of each particular class of animals; and remarks that in the vertebrata the size of the corpuscle is perhaps in a ratio inverse to that of the activity and extent of the function of respiration.

The author states that he has been led to these views, which appear to him to apply to animals generally, by an examination of the corpuscles, and by watching the changes which take place in the blood in lepidopterous insects; and he points out their accordance with those of Wagner, Henle, and Wharton Jones, with regard to the function of the corpuscles; but proposes to give the details on which his own view respecting the size of the corpuscle is founded on a future occasion.

He then enters more particularly on the consideration of the forms of corpuscle in the blood in the Articulata, which he marks as four; although, he observes, they are in reality only so many stages of development of one ultimate structure. These forms are,—first, the *molecules*, which he regards as comparable to the molecules observed in the chyle of Vertebrata by Mr. Gulliver; secondly, the *nucleated* or *oat-shaped corpuscle*, which he believes with Wagner are analogous to the white, or chyle corpuscles of Vertebrata; thirdly, the *spherules*, or minute rounded bodies developed from the oat-shaped corpuscle, and which he believes are analogous to the free nucleoli of Valentin, and probably to the very minute white, opake granules constantly observed in the blood of vertebrata; and lastly, the *discs*, which are further developments of the spherules, and analogous to the true red blood-discs of the higher animals, and which, as he states in a subsequent part of his paper, in his examination of the blood of the human fœtus, he believes that he has also traced from the white, opake granules or spherules.

The author then proceeds to describe these forms of the corpuscle in insects more minutely, and enters into considerable detail with reference to the oat-shaped corpuscle, tracing it from its earliest distinct form, before any nucleus is perceptible in it; and shows that the nucleoli which constitute this body are gradually increased in number, until the corpuscle has attained its full size, when it first changes its form and becomes shorter, then rounded, and afterwards entirely breaks up and liberates the nucleoli that have been developed within it. This change of form he shows always takes place very rapidly in all the oat-shaped corpuscles, large and small, when out of the body, and to this circumstance he attributes the diversity in the descriptions that have been given by various observers of the form of the corpuscle. He shows also, that, with reference to the function of this body, the corpuscles are usually found in greatest number during the act of breaking up, immediately before the larva

is preparing to change its skin, at which time the blood is extremely coagulable; and that there are fewest corpuscles, or that there is the greatest number of small corpuscles of this kind, soon after the caterpillar has again begun to feed. When the insect has assumed the pupa state, nearly the whole of these corpuscles are broken up. The greatest abundance of them is found in the act of changing on the third or fourth day of the pupa, after which the number of these corpuscles is gradually lessened, until, when the insect has entered the perfect state, very few remain. When the change to the perfect insect occurs, there is another opportunity of watching the function of this corpuscle. When the wings are being expanded and still soft, a few oat-shaped corpuscles circulate through them; but as the wings become consolidated, these corpuscles appear to be arrested, and break down in the circulatory passages, supplying directly the material for the consolidation of these structures; as appears from the entire arrest of circulation in these parts, and from the granular remains of the corpuscles which may be seen by transmitted light in a wing completely denuded of its scales on the upper and under surfaces. The spherules and discs of the perfect lepidopterous insect are then noticed; and some peculiar clavate or fiddle-shaped bodies, which appear to be the transition forms between spherules and discs, are pointed out as occurring in the blood of one of the night moths, *Xylophasia polyodon*, and also in the butterfly soon after it has left the pupa state. These facts are regarded as proofs, derived from direct observation, of the function of the corpuscle, and of its analogy, both in function and development, to the secreting cells of glands.

In the second division of his paper, the author draws some comparisons between the blood-corpuscles of insects and the vertebrata, and gives the details of a series of observations on the blood of a human fœtus that was born alive at the end of the sixth month. He examined the blood of the parent, and of the placenta, and also of different parts of the body of the fœtus a few hours after death, and found in general that the blood of the parent contained a very large quantity of white chyle corpuscles, and was extremely coagulable: the blood of the placenta contained, beside an abundance of chyle corpuscles, red blood-discs of extremely variable sizes, the largest being one-third or one-fourth larger than those of the mother, and the smallest scarcely more than one-fourth as large as the largest. There were also an immense abundance of molecules and nucleoli, from which latter the red blood-discs appeared to be developed. The blood of the vein and lungs presented a similar irregular condition as to size of the corpuscles, while that of the left auricle of the heart, aorta and arteries of the cord was more uniform in its character. From these observations the author concludes, that the blood of the vertebrata is analogous in its mode of development to that of the insects and other invertebrata, and that the red blood-discs are the ultimate developments of the opake white granules or nucleoli of the blood.

Drawings illustrating the subjects accompany the paper.

February 13, 1845.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

'Αμόρφωτα, No. 1. "On a case of Superficial Colour presented by a Homogeneous Liquid internally colourless." By Sir John Frederick William Herschel, Bart., F.R.S., &c.

The author observed that a solution of sulphate of quinine in tartaric acid, largely diluted, although perfectly transparent and colourless when held between the eye and the light, or a white object, yet exhibits in certain aspects, and under certain incidences of the light, an extremely vivid and beautiful celestial blue colour, apparently resulting from the action of the strata which the light first penetrates on entering the liquid; and which, if not strictly superficial, at least exert their peculiar power of analysing the incident rays, and dispersing those producing the observed tint, only through a very small depth within the medium. The thinnest film of the liquid seems quite as effective in producing this superficial colour as a considerable thickness.

February 20, 1845.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

"Additional Remarks respecting the Condensation of Gases." By Michael Faraday, Esq., F.R.S. &c.

The author, suspecting the presence of nitrogen in the nitrous oxide on which he had operated, repeated his experiments with this gas, very carefully prepared from pure nitrate of ammonia, but the results still indicated the presence of a more volatile gas mixed with another less volatile. He found that olefiant gas is readily soluble in strong alcohol, æther, oil of turpentine, and other bodies of the same kind; and that, like the former gas, it seems to be of a compound nature. His experiments confirm the prevalence of the law that the force of vapour increases in a geometrical ratio for equal increments of heat, commencing at a given amount of pressure. The more volatile a body is, the more rapidly does the force of its vapour increase by an augmentation of temperature, the increase of elasticity being directly as the volatility of the substance. By further and more accurate investigation, a general law may be established for deducing, from only a single observation of the force of any given vapour in contact with its fluid, its elasticity at any other temperature.

Postscript to the Paper by Sir John F. W. Herschel, Bart., F.R.S., read at the last meeting.

The author found that neither cinchonine nor salicine, in a state of great purity, possessed, in the smallest appreciable degree, the optical property which he has shown to belong to quinine.

February 27, 1845.

SIR JOHN WILLIAM LUBBOCK, Bart., V.P. and Treas. in the Chair.

"An Account of Compact Aluminum." By Professor F. Wöhler of Göttingen, in a Letter to Thomas Graham, Esq. Communicated by Thomas Graham, Esq., F.R.S.

The author has lately found, contrary to the results of his former researches on aluminum made eighteen years ago, that this metal is readily fusible, and that in its reduction from the chloride of aluminum by means of potassium, it presents itself in the form of fused globules, generally so small that their shape is not distinguishable under the microscope, although occasionally they are met with having a sensible diameter. He effects the reduction at once in a clay crucible, the bottom of which he covers with pellets of pure potassium, and places upon these the chloride of ammonium, covering the whole with chloride of potassium in powder. The crucible being then closed up, and heated in a coal fire, the reduction is instantly effected.

Fused aluminum has the colour and lustre of polished tin; it continues perfectly white in the air; it is fully malleable, and the globules may be beaten out into the thinnest plates without cracking at the edges. It is entirely unmagnetic. In other respects the metal in this compact state has the properties which the author formerly ascribed to it.

March 6th, 1845.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

"Essays on Hygrometry and Barometry." By Captain Shortrede, F.R.A.S., First Assistant in the General Trigonometrical Survey of India. Communicated by Lieut.-Col. W. H. Sykes, F.R.S.

This paper commences with an account of the various investigations of the author on subjects relating to the elasticity of aqueous vapour at different temperatures and under different circumstances. He first discusses the tables given by different experimentalists of the force of vapour at various temperatures, and endeavours to deduce an analytical formula giving the nearest approximation to the results recorded. He then proceeds to the consideration of what he terms "the moist bulb problem," or the point of maximum depression attained by a thermometer with a moistened bulb exposed to evaporation in air: he deduces formulæ which he compares with the results of actual observation, and points out the probable sources of error in the cases in which he finds disagreements between them. In the miscellaneous remarks which form the next section of the paper, the author states his reasons for dissenting altogether from the views taken by Dalton of the constitution of mixed gases, or of

mixtures of aqueous vapour with any of the gases, according to which, each gaseous body is uniformly diffused throughout the whole space, its particles repelling those of its own kind, but exerting no pressure on the particles of any other kind. He considers the fact that a given portion of air has its volume expanded by the addition of aqueous vapour, as being of itself a sufficient refutation of that theory. The author then takes occasion to discuss the question, whether aqueous vapour exists in the atmosphere in the state of mechanical mixture or of chemical solution, and argues in favour of the latter view of the subject.

In the concluding section, the author enters at large into the investigation of the method of ascertaining heights by barometric observations, and gives various tables to be used for that purpose.

April 3, 1845.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

'Αμόρφωτα, No. 2. "On the Epipolic Dispersion of Light; being a Supplement to a paper entitled 'On a case of Superficial Colour presented by a Homogeneous Liquid internally colourless.'" By Sir John Frederick William Herschel, Bart., F.R.S. &c.

The author inquires whether the peculiar coloured dispersion of white light intromitted into a solution of sulphate of quinine, is the result of an analysis of the incident light into two distinct species, or merely of a simple subdivision analogous to that which takes place in partial reflexion, as exemplified in the colours of thin plates. He endeavours to ascertain the laws which regulate this singular mode of dispersion, which for brevity he terms *epipolic*, on account of the proximity of the seat of dispersion to the intromitting surface of the fluid. It might have been expected that by passing the same incident beam successively through many such dispersive surfaces, the whole of the blue rays would at length be separated from it, and an orange, or red residual beam be left: but the author establishes, by numerous experiments, the general fact, that an *epipolical beam of light*, meaning thereby a beam which has been once transmitted through a quiniferous solution, and undergone its dispersing action, is incapable of farther undergoing epipolic dispersion.

There were only two liquids, out of all those examined by the author, namely oil of turpentine and pyroxylic spirit, which, when interposed in the incident beam, act like the solutions of quinine in preventing the formation of the blue film: and the only solid in which the author discovered a similar power of epipolic dispersion, is the green fluor of Alston Moor, and which by this action exhibits at its surface a fine deep blue colour.

April 17, 1845.

Sir JAMES CLARK ROSS, V.P., in the Chair.

"Description of a Self-registering Thermometer." By Mr. Mansfield Harrison. Communicated by James Alderson, M.D., F.R.S.

The instrument here described is composed of two parallel bars, the one of iron and the other of copper, united at their lower end, and registering their differences of expansion by heat, by means of a series of multiplying levers, carrying a pencil which is made to press on paper wound round a cylinder moved by clock-work.

"On the Viscous Theory of Glacier Motion. Part I. containing Experiments on the Flow of Plastic Bodies, and Observations on the Phenomena of Lava Streams." By James D. Forbes, Esq., F.R.S. Lond. and Edin., Corresponding Member of the Institute of France, and Professor of Natural Philosophy in the University of Edinburgh.

The author adduces some new experiments in confirmation of his theory of the nature and causes of the motion of glaciers, and which present an analogy with the phenomena exhibited by the flow of masses of semifluid or viscous matter contained in a narrow channel, along which they move by the force of gravity; and also with the ripple marks on the surface of a stream of water when its course is impeded by obstacles. These latter phenomena, he remarks, were noticed and accurately described by Leonardo da Vinci. Analogies of a still more striking nature are presented by the appearance of streams of lava in their flow from volcanos and in the progress of their descent, which illustrate a great number of the phenomena of glacier motion, and corroborate the views of the author as to their nature and as to the laws they obey. Various quotations are given from authors who have been struck with this analogy, and who have pointed it out more or less circumstantially in the narratives of their travels in the neighbourhood of Etna and Vesuvius; to which the author adds some of his own observations on the lava from these mountains, which throw further light on the subject.